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DEPARTMENT OF THE INTERIOR  
BUREAU OF MINES

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ADJUTANT GENERAL	ANALYST
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Health and Safety  
District C

Mount Hope, West Virginia  
February 1, 1965 wjp

Memorandum

To: W. R. Park, District Supervisor

From: James L. Gilley, Mining Health and Safety Engineer

Subject: Report on investigation of coal bumps, Olga mines, Olga Coal Company, Coalwood, McDowell County, West Virginia, November 24, 1964

On November 24, 1964, at 9:45 p.m., a coal bump of considerable magnitude occurred in the 2 west section of the subject mine. A second bump of lesser magnitude occurred on this section approximately an hour later at 10:50 p.m. The section was idle, no one was in the area, and there was no damage to mining equipment.

Mine Superintendent Homer Hickam notified the writer of these occurrences at 6 a.m., November 25, 1964. An investigation was started at 8 a.m. that day by Mr. Hickam and the writer, and the investigation was continued on November 27 and 30, 1964, by Messrs. D. C. Ridenour, general superintendent, W. R. Wotring, safety director, Hickam and the writer. Some aspects of the investigation, however, continue at this writing. The section resumed operation on December 1, 1964, and pillar extraction on the right side of 2 west (the active area at the time of the November 24 bumps) was completed to the projected extraction limits on December 23, 1964, without the recurrence of coal outbursts.

Olga mines operate in the low-volatile No. 4 Pocahontas coal bed through several shafts ranging in depth from 445 to 870 feet. The coal bed ranges from 56 to 96 inches in thickness and is 78 to 80 inches in thickness in 2 west, the area involved in the bumps. Total employment is 402 men, 302 worked underground and 100 on the surface. Production averaged 7,000 tons of coal on a double-shift basis, 5 days a week. The coal is loaded with continuous miners and with 14BU and 11BU Joy loading machines. Main haulage is by electric locomotives.

The mine is developed by a multiple-entry system, and pillar extraction follows a block room-and-pillar method of development. Main entries

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were developed in groups of 8 to 12 and cross or panel entries in sets of 5 and 6. Entries were 16 to 18 feet in width on 75- and 85-foot centers. Rooms were on 75-foot centers and 18 feet in width. Crosscut centers ranged from 80 to 105 feet. Pillars were extracted by the alternate open-end pillar lift method; the pillar lifts were projected to be mined 22 feet in width as a maximum. This pillar extraction plan, however, is altered somewhat in areas where coal outbursts are most likely to occur, such as in the 2 west section. Only one open-end lift is mined at a time in the pillars.

The immediate roof in 2 west, the area involved in the bumps, consists of hard, dark gray, carboniferous shale ranging from 10 to 28 inches in thickness in the 5 right or active mining area and increasing to as much as 48 inches in thickness on the left side (inby barrier) of 2 west. The main roof structure in this vicinity is predominately massive gray Mahoning sandstones. The immediate roof is overlain by a stratum of very hard, gray, fine-grained sandstone successively overlain by a stratum of dark shales ranging up to 6 feet in thickness and a massive stratum of sandstone 114 feet thick. According to the logs of drill holes on the property, there are several other overlying stratum of sandstone ranging from 24 to 77 feet in thickness.

The topography overlying 2 west area is rugged, and some of the mountains reach 2,450 feet in elevation and exceed 900 feet in relief. The cover over the 2 west area ranges from 900 to a maximum of 1,450 feet.

The mine floor in the 2 west territory is comprised of dense, sandy siltstone or fire clay ranging up to 5 feet in thickness, and it approaches sandstone in compressive strength. This formation is generally underlain by a stratum of sandstone ranging up to 44 feet in thickness. Very little heaving of the mine floor has occurred in 2 west during the years 1963 and 1964.

The adopted roof-support standards in the 2 west section were adequate and suitable for the roof conditions and mining systems. The plans incorporated use of posts, 3-piece timber sets, cribs, and roof bolts. Twenty-ton capacity jacks were also used occasionally.

The section foreman on the 2 west section, at the end of his shift (3:30 p.m.) November 24, 1964, reported that the roof in the area from which the last 5 pillars had been extracted was "working and taking weight" and that a fall would likely occur during the night. The 2 west section operates only on the 7:25 a.m. to 3:25 p.m. shift, and maintenance and construction work is normally performed on the 12 midnight to 8 a.m. shift. Decision to operate th 2 west section only on 1 shift a day was made about 4 months previously.



On November 24, 1964, at 9:45 p.m., a shock or shear wave of considerable amplitude was perceived on the surface by several persons within a radius of 3 miles or more from the Olga mines. Mine Superintendent Hickam called the dispatcher underground and instructed him to notify the second-shift mine foreman to ascertain, as soon as possible, if a coal outburst had occurred in the 2 west section. The second-shift mine foreman arrived on the 2 west section about 10:15 p.m. and discovered that a coal bump had occurred, as evidenced first by the dispersal of rock dust along the haulage road some distance outby the entrance to 5 right (the active working area of 2 west). Also, coal was shaken and/or expelled from the ribs of the pillars, and posts were dislodged from under some of the crossbars (roof was also bolted) along the 5 right haulage road. After ascertaining that the trolley wire was not dislodged and that the electric power was cut off (the power had been cut off the section at the end of the day shift, 3:25 p.m.) the second-shift foreman placed a "danger board" at the entrances to the 2 west section, then informed the mine superintendent of his findings. A complete examination or survey of the section was not made at this time; consequently, the magnitude and extensiveness of this individual bump are not known. The foremen did report, however, that the roof in 5 right and inby 5 right of 2 west continued to "work" when he left the section.

At 10:50 p.m., or about 15 minutes after the second-shift night foreman left the section, another bump occurred in 2 west. Although the stress wave of this bump was also perceived on the surface by several persons living in the community, reportedly, its amplitude was considerably less than that of the previous bump.

The third-shift mine foreman was at the mine when the second bump occurred, and he, accompanied by an assistant foreman, visited parts of the active area of 2 west to evaluate conditions and ascertain the extensiveness or damage caused by the bumps. Individual reports from the second-shift and the third-shift mine foremen indicate that the second bump resulted in additional coal being expelled from the ribs of some of the pillars, including the large trapezoidal-shape pillar at the entrance to 5 right, and slight upheaval of the floor for a distance of about 100 feet along the haulage road outby 5 right. Practically all pillars in the accessible areas inby 4 right were affected to some degree. Roof falls had not occurred in any of the active roadways (most were roof bolted), but roof material was shaken down at a few unsupported locations in some of the old entries and airways. A fall also occurred in the gob area in which two pillars had recently been extracted.

The two overcasts (neither of which is in use) near 5 right were damaged to some extent by the tremors and concussion. Ten temporary



stoppings were either damaged or torn out by the stress-relief waves. The 2 west haulageway opening in the abandoned area inby 5 right was completely closed by the violent bump of a large coal pillar. The mine floor immediately adjacent to this pillar was uplifted and was thrown against the roof. The fact that this pillar, as well as several other similarly large pillars (developed during 1935) in the area, could not be mined in sequence because of the extensiveness of surrounding roof falls were recognized and considered as future coal outbursts potentials. Consequently, an area that included most of these unmineable coal pillars inby 5 right was abandoned in 1960 and "dangered off." It is well to note that two large chain pillars outby the abandoned area at 5 right, and which assuredly would have become violent coal outburst potentials, were extracted recently, but sufficiently in advance of the retreating extraction line. Development of the inby barrier pillar on the left of the 2 west entries was completed on August 5, 1964, about 5 months in advance of the pillar extraction sequence. This was accomplished primarily to permit load readjustment during the interim and thus reduce the bump potential while mining the pillars.

Currently, mining in 5 right was reduced to a very small area (only 8 pillars remained to be extracted) between extensive old gobs and the recently mined-out areas. Several pillars were abandoned inby the active area because of extensive roof falls, steep grades, and water. Another factor of contributing significance is that current mining in 2 west was approaching an area where the centers of entries changed from 75-90 to 40 feet, resulting in the formation of pillars of various dimensions and strength. The thin entry chain pillars intervening between the 5 right area and the barrier pillars on the left side of 2 west, in effect, acted as yield pillars. These pillars continued to yield slowly for several weeks prior to the bumps on November 24. Gradual pressure increases were evident for several weeks upon the large trapezoidal-shaped barrier pillar at the entrance to 5 right and upon the pillars immediately adjacent thereto.

On November 20, 1964, at 11:30 a.m., there was a spontaneous release of energy induced primarily by stress impingement or build-up in this immediate area. Coal was shaken from the angle side of the trapezoid barrier pillar and from the outby ribs of the four pillars inby this barrier pillar; however, pillars in the active extraction area of 5 right and inby 5 right were not affected. Incidentally, the gage connected to the hydraulic pressure cell (No. 234) installed in the barrier pillar at the time showed a pressure increase from 5,700 p.s.i. on November 9, 1964, to 7,750 p.s.i. on November 16, 1964. The pressure at this station immediately before the bump on November 19, 1964, unfortunately, was not recorded; but, at the time of the writer's investigation the following day, the pressure at this test station had

dropped to zero; most likely the oil line had been severed by the bump. (The two hydraulic pressure cell test stations in two coal pillars near the active extraction line had been completed prior to the bump on November 24.)

The 2 west section is nearly bordered on 3 sides by "faulted" areas. Whether the bump on November 24, 1964, was significantly influenced by these geologic conditions is not known. The incidence of bumps in this and other mines are definitely influenced by the structure of the rock formations overlying the coal bed. The overburden in 2 west varied from 900 to 1,450 feet. Mine maps on file in the Mount Hope office of the Bureau of Mines shows locations of some of the bumps that have occurred in the 2 west section during the last 6 years, the areas affected by the bumps that occurred on November 24, and other information.

In summary, information obtained during the investigation of the bumps on November 24 suggests that the relationship between them is highly improbable to differentiate and therefore the resultant magnitude, including the difference in the degree of violence of bumps and degree of stress release at specific locations, must be considered as a composite of the two bumps. Furthermore, evidence indicated that each bump in all probability was the product of several bumps, perhaps occurring at fractional-second intervals.

Following the investigation on November 30, 1964, it was learned as a result of an inquiry by telephone, that the 9:45 p.m. bump was recorded at the seismic stations at Blacksburg, Virginia, Oak Ridge, Tennessee, and in Iowa.

Mining patterns in the 2 west territory have been complicated in several localized areas because of steep grades, water, and extensive roof falls especially in the old development. Consequently, many complete pillars as previously mentioned were abandoned. It is not unreasonable to assume that the bump at 9:45 p.m., November 24, could have originated by one or more of the unmined pillars in the abandoned area bumping with a resultant chain reaction from the stress wave in the roof and floor measures.

History of the 2 west territory and knowledge of the existing natural conditions conducive to coal outbursts have been considered in the mining plans of the area. The bump-potential history of the area resulted in a cooperative research and study by the company and Bureau of Mines in 1962. During the past 3 years, hydraulic pressure cells that indicate pillar pressure changes have been utilized to obtain additional information on the bump phenomenon. Information gained by use of these cells has been encouraging and beneficial on several occasions. Bumps of significance

had not occurred in the 2 west section for a period of nearly 18 months, from May 1962 until November 7, 1964. The cooperative research and study of coal outbursts in the Olga mines is continuing.

/s/ James L. Gilley

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